

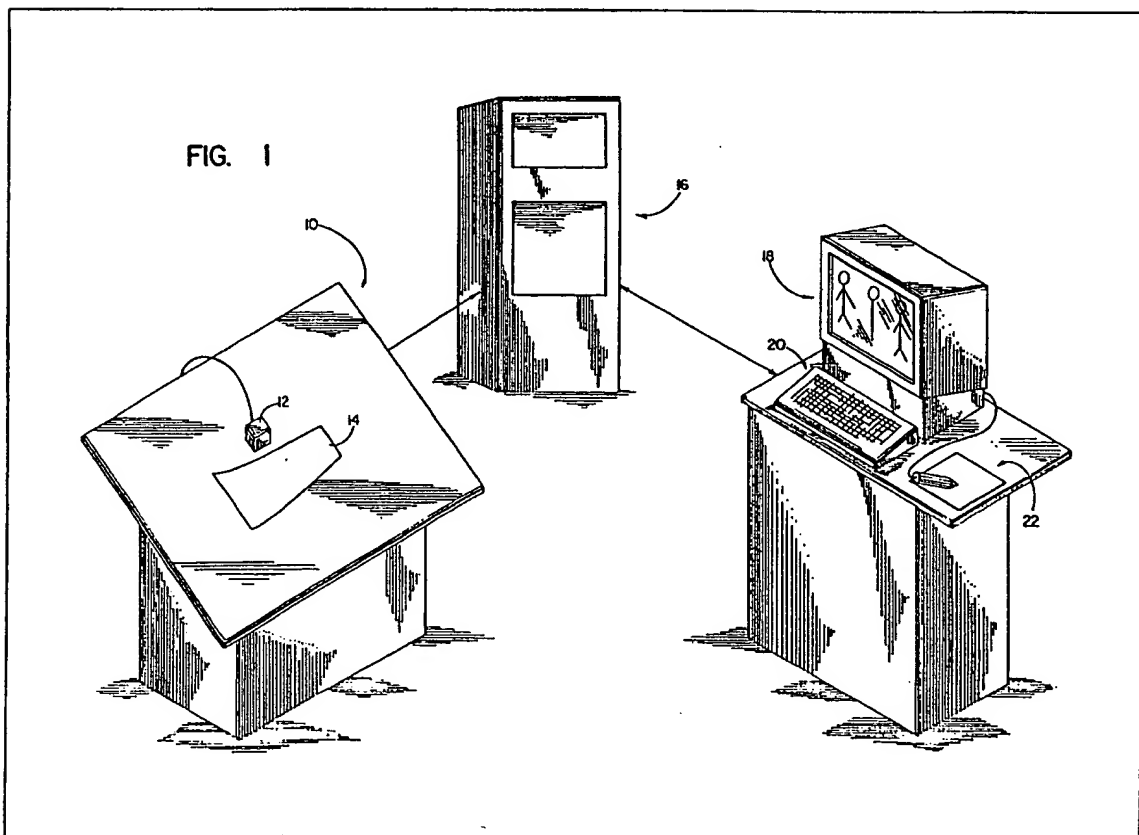
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(54) Three dimensional design from stored parts

(57) Computer aided design of articles with a digitizer for part definition, a controller with memory and processing capacity for a multitude of parts, and an image producer with an associated interactive means. The image producer may be a CRT screen, a laser projection system for 3-D holographic image reproduction, a multi-color stereoscopic system, or a multiple projection system with selectively polarized image production and viewing. A designer operator selects parts, views the assembled parts, revises and refines interactively, and thus provides a final design ready for manufacture.



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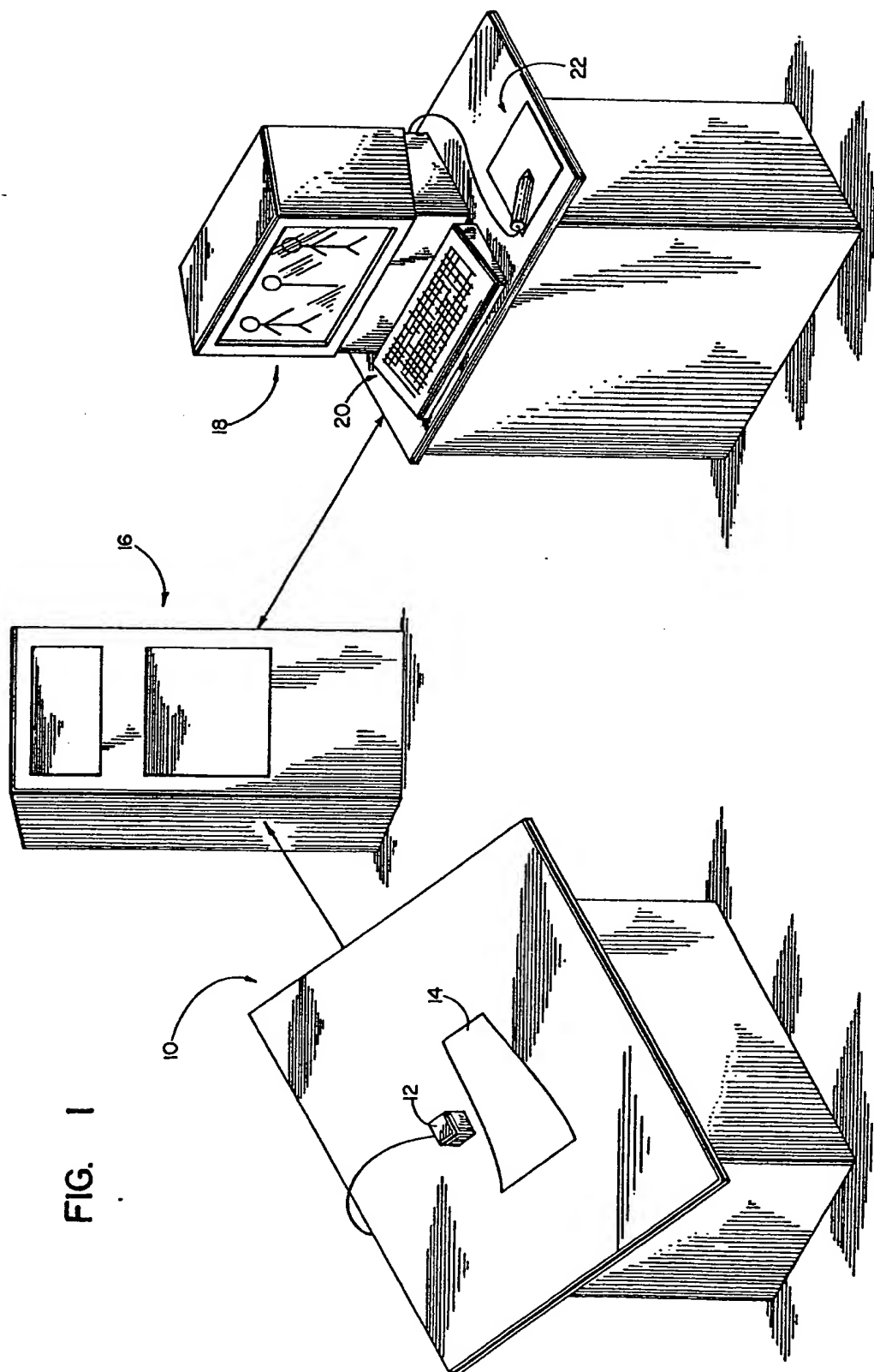


FIG. 2

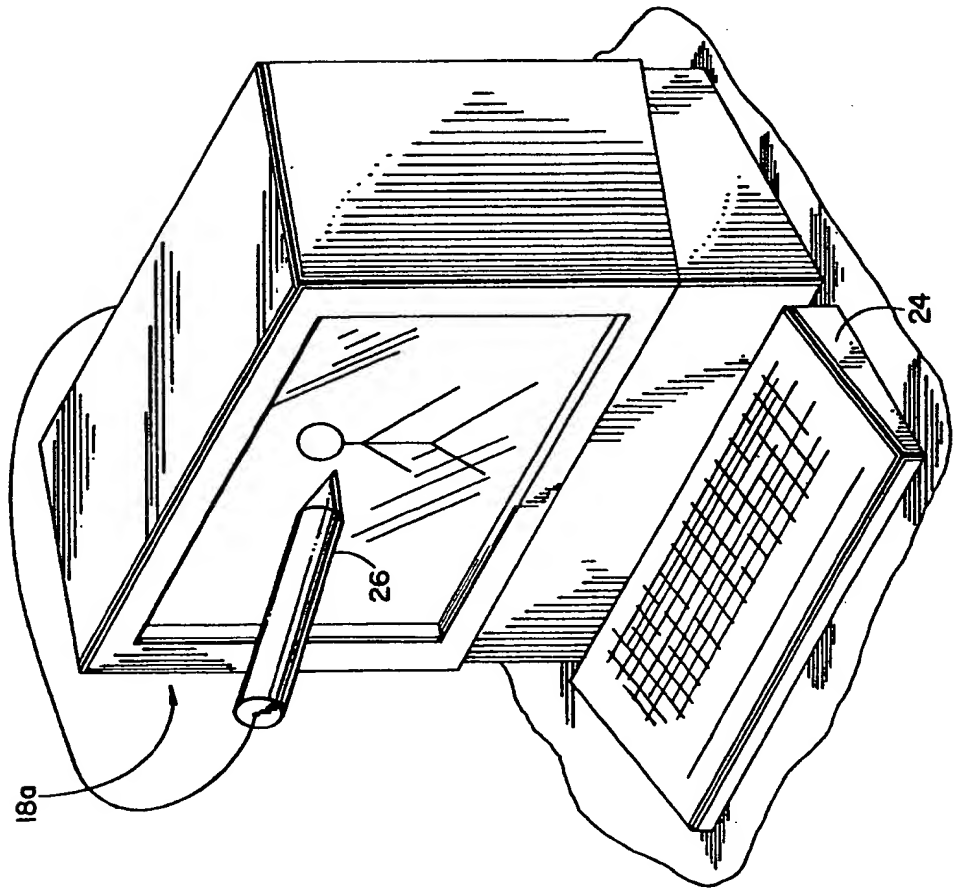


FIG. 3

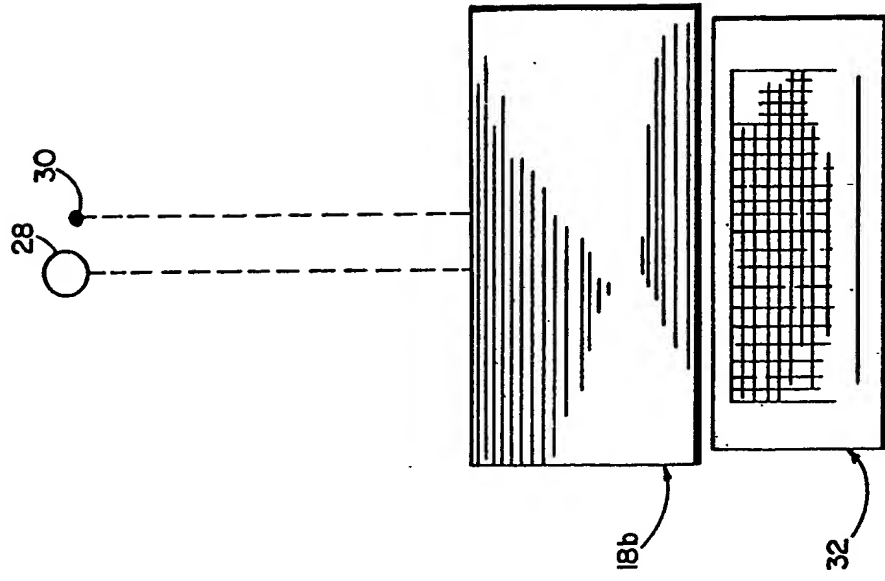


FIG. 4

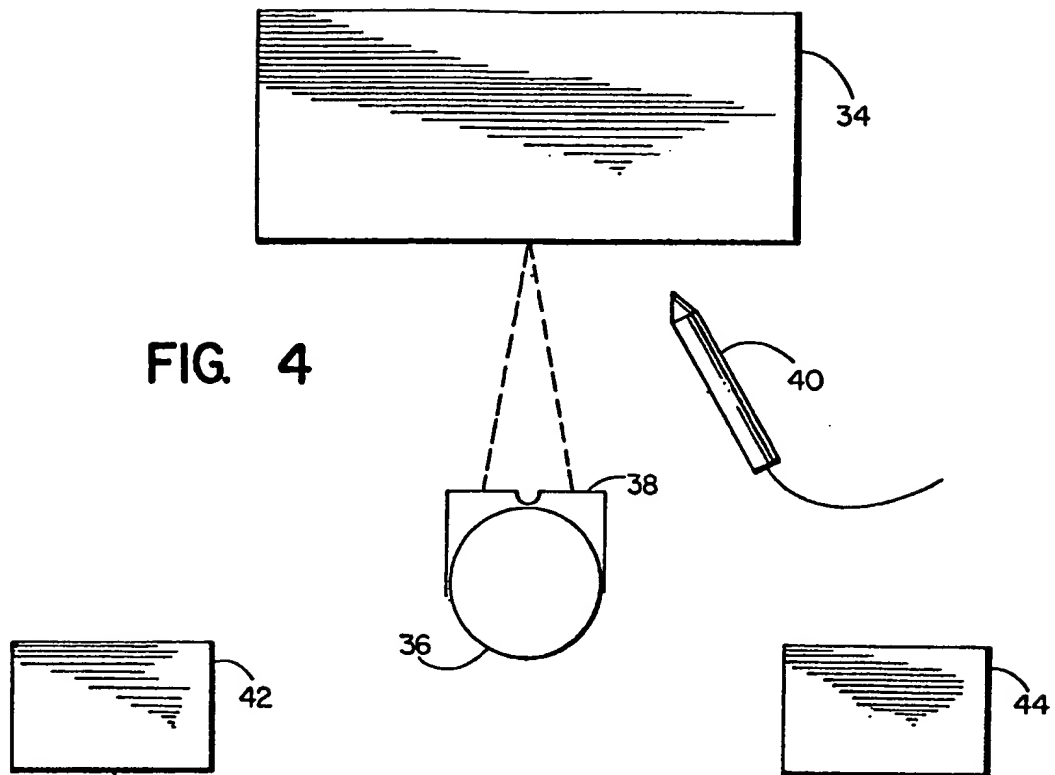
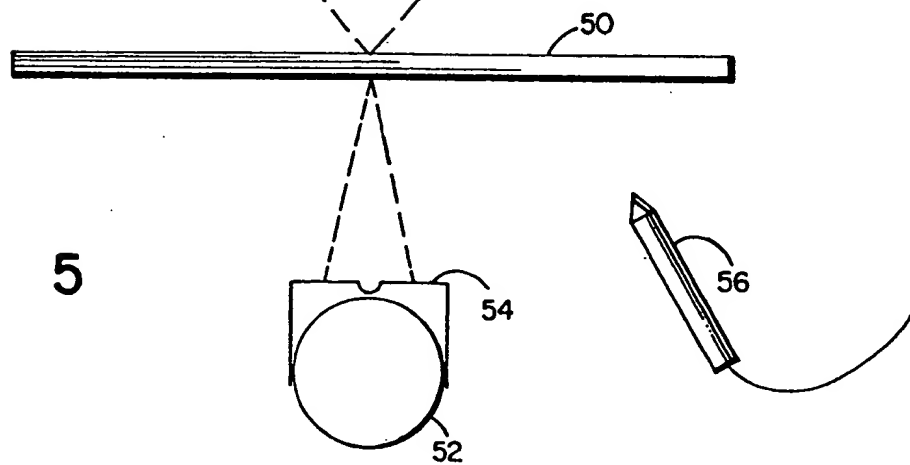


FIG. 5



## SPECIFICATION

## Three dimensional design from stored parts

The design of new articles of apparel is currently a manual operation. Proceeding from an image in the mind of the creative designer a sketch or other pictorial representation may evolve followed or perhaps preceded by the cutting of sample cloth patterns, draping on a body form, cutting, trimming and otherwise refining as required to reproduce the style envisioned. The procedure is obviously open to substantial improvement in the mechanics of reducing a mental image to a completed design ready for manufacture and perhaps even the creative genius of the fashion designer can be enhanced.

Whether a pictorial representation or a three dimensional cutting and draping operation is employed, the designer recalls by genus or species the necessary parts of the article of apparel. While the recall may be instantaneous the pictorial representation or the cutting and draping operation is obviously time consuming. For example, the collar that will perfectly compliment the dress may not immediately come to mind and there may be a sequential recall and application of various types of collars (genus) and thereafter various species within the genus. Recall is fast but implementation slow and the former is incomplete. On a bad day the best fashion designer may recall only a small percentage of the multitude of collar designs which he has seen over the years. We have thus identified a need for a system for designing articles from stored parts wherein the designer's recall is enhanced, the reduction of his mental image to a final design for manufacture is greatly expediated, and wherein his imagination and creative genius is substantially enhanced. An aim of the invention is to provide a system offering improvements in one or more of these respects.

The system is described and illustrated below in relation to the design of articles of apparel but it also has general purpose utility as in machine design, etc., and the invention is not limited to the design of any specific type of article.

In embodiments described below, a greatly expanded memory is provided as a design tool and this serves to better spark the imagination and fuel the creative genius of the designer in the continuing process of mental image development and the concurrent external representation thereof. Of equal if not greater importance, the mechanics of revising and refining the external representation of the designer's mental image are greatly facilitated.

A multi-view two dimensional or a three dimensional display of a multi-part article of apparel is provided in association with a computer memory and processing means for classifying and storing a multitude of apparel parts. Retrieval means enable the designer to instantaneously call up selected parts or groups of parts and part substitution and replacement can be achieved instantaneously and without time consuming

revisions of pictorial representations, cutting, draping, etc. When a final part selection has been made, further expeditious revision and refinement is possible with a manually operable interactive means for modifying characteristics of displayed apparel parts. Further, part characteristics can be simultaneously modified in both image and memory form whereby to create a final memory design of an article of apparel which is reproducible for direct manufacture of the article and/or its component parts.

In one form of the invention, the apparel parts take the form of conventional two dimensional pattern pieces rendering the system component part design output compatible with and usable as input pattern design information for a conventional pattern grading and marker making system. In another embodiment the apparel parts may take a three dimensional form compatible with apparel manufacture employing contour molding processes and the like.

The external representation of the designer's mental image may be provided on a conventional CRT display screen in two dimensional images but in a plurality of views, for example, front, back, side, etc. Simulated three dimensional images may also be provided on a conventional CRT display screen for multiaxis rotation for viewing, part selection, and interactive revision and refinement. Laser technology may be employed for projection of a holographic three dimensional image as well as multi-color stereoscopic image production, and polarized projection and viewing.

Interactive means for the designer may include conventional keyboard terminals, stylus-data-tablet systems for revision screen displayed designs, direct stylist to screen systems, etc.

Apparel part definitions for memory entry may be accomplished with a two dimensional digitizer handling conventional flat pattern pieces and with memory and processing means converting to three dimensional digital definitions for image display. Alternatively, flat two dimensional pattern pieces may be converted to three dimensional drawings or other representations, digitized and processed directly for display. Three dimensional designer implemented part revisions and refinements may be converted to two dimensional form for corresponding revisions and refinements in two dimensional pattern piece definitions. Conventional pattern pieces or patterns so defined may then be employed directly in pattern grading and marker making systems.

When contour molding processes and the like are contemplated in the manufacture of articles of apparel, three dimensional part definitions in original or refined form may be employed as input information in form and mold design. In this instance, the apparel parts may depart substantially from the conventional pattern or pattern piece form and the article of apparel may be otherwise divided into parts as required and may even be of unitary construction. Part storage is of course adapted accordingly.

With the expanded computer memory, part

classification is also contemplated as with a genus-species system. Thus, dress collars, for example, will be classified as to genus and species and when the designer has a vague image in mind as to a certain collar which might compliment and perfect his dress design, he can readily recall the proper genus and then sequence through the species thereunder arriving finally at the perfect collar from storage, or with slight revision and refinement through the interactive means at his disposal. Thus, limitations of the human memory can be obviated and the designer's imagination enhanced accordingly.

Fig. 1 of the drawing is a schematic

representation of a first form of the invention,

Fig. 2 is a partial schematic representation of a second form of the invention,

Fig. 3 is a partial schematic representation of a third form of the invention,

Fig. 4 is a partial schematic representation of a multi-color stereoscopic system, and

Fig. 5 is a partial schematic representation of a polarized projection and viewing system.

Referring particularly to Fig. 1, a digitizer

indicated generally at 10 may be conventional in form and includes a probe 12 for tracing the outline of a part or conventional pattern piece for an article of apparel 14. The part 14 may, for example, comprise a portion of a pant leg and may be digitized in flat form or, alternatively, three dimensional digitizing can be provided for as, for example, by providing a series of drawings of the part as contoured in its assembled position on a wearer or a body form. When flat or two dimensional digitizing is employed a controller indicated generally at 16 provides for conversion to a three dimensional digital definition of the part. When three dimensional digitizing is provided for at the digitizer 10, the controller 16 may store, process, and input directly to an image producing means 18. Apparel parts accommodated by the digitizer 10 may comprise conventional patterns or pattern pieces, apparel parts otherwise defined and delineated, unitary articles of apparel, accessories, etc.

A controller 16 provides the necessary memory and processing means for storing, classifying and processing a multitude of parts for articles of apparel. Conventional computer systems may be employed in accordance with the memory and processing functions desired.

The image producing means 18 in Fig. 1 may comprise a conventional CRT screen for displaying apparel parts or selected groups of apparel parts in contoured and assembled positions whereby to form physical articles of apparel. In the Fig. 1 system, the various parts of the articles of apparel are shown in contoured and assembled positions but the display is essentially two dimensional with front, side and back views of the assembled articles of apparel. The articles of apparel are shown assembled on a human-like form which may represent a model, body form, or alternatively, the article of apparel may be displayed suspended in space. The various parts of

the article of apparel may be assembled in their relative positions by an appropriate program in controller 16 or, alternatively, the designer operator may call up individual parts and move the same into assembled position.

Retrieval means and manually operable interactive means associated with the screen 18 are indicated generally as a conventional keyboard unit 20 and a data tablet and stylus 22.

Conventional elements may be employed with the designer operator calling up the desired apparel parts at the keyboard 20 and/or tablet 22 and revising and refining parts with the aid of the stylus and data tablet 22 and an associated cursor appearing on the screen 18. Revisions and refinements in the design of the article of apparel and its component parts as implemented by the designer operator are thus effected in both image and memory form and a final and reproducible design for an article of apparel and its component parts is thus created. Three dimensional revisions and refinements may then be converted to revised two dimensional digital definitions of the component parts of the article by the controller 26 for subsequent use by a conventional pattern grader and marker maker such as the AM-1 or AM-5 Pattern Grading and Marker Making System manufactured by Gerber Garment Technology, Inc. of South Windsor, Connecticut.

When the system of Fig. 1 is employed with a contour molding process in the manufacture of articles of apparel, the apparel parts may be otherwise defined and delineated as indicated above and three dimensional digital definitions of parts or unitary articles of apparel may be provided by the controller 16 for use in further manufacturing operations.

In Fig. 2, an image producing means in accordance with the invention comprises a CRT screen indicated generally at 18a forming a part of a system including a controller such as the controller 16 and a digitizing means which may be similar to the digitizer 10 or which may take any other form capable of providing digital definitions of apparel parts to the controller. The display includes a conventional keyboard terminal 24 for information retrieval and input and a conventional stylus 26 for direct use on the display screen in revision and refinement of the apparel parts by the designer operator. The display provided by the unit 18 may be of the simulated three dimensional type with the apparel parts in contoured assembly on a model, body form, etc. That is, the display may take the form of a simulated three dimensional article of apparel which is rotatable about one or more axes for overall viewing by the designer operator. The system may include for example IBM's Virtual Machine/Conversational Monitor System (VM—CMS) in association with an IBM 4331, 4341, 3881 or other compatible computer. Operation of the system with the Fig. 2 image producing, retrieval and interactive means may be substantially identical to the operation of the Fig. 1 system described above.

In Fig. 3 a laser projection means indicated

schematically at 18b constitutes the image producing means of the present invention and projects an image 28 in space in the form of a hologram. As in Figs. 1 and 2, the apparel parts are assembled on the three dimensional image in contour form and designer operator interaction is provided for by a laser projected cursor 30 and a retrieval and control means in the form of a conventional keyboard 32. Overall operation of the system may be substantially identical with that described above.

In Fig. 4 an image producing means comprising a multi-color display screen 34 unit which may for example employ the currently conventional red-green system. A designer viewer 36 uses the conventional red-green or other multi-color viewing glasses 38, and revises and refines the three dimensional image with a stylus or other interactive device 40. Single or multiple display screens may be employed.

In Fig. 5 a multiple projection system has projectors 42, 44 and associated polarizing units 46, 48 which may be for example respectively provide vertical and horizontal polarization of an image. Display screen 50 is viewed by designer 52 through polarized glasses 54 to provide three dimensional images which may be revised and refined with interactive device 56.

As will be apparent from the foregoing, the computer aided design system of the embodiments provides for substantial enhancement of memory capacity, a resulting enhancement in the imagination and creative genius of the designer operator, and in a greatly improved production rate in reducing a design concept to a final design ready for manufacture.

#### CLAIMS

1. A system for designing articles having component parts comprising:
  - memory and processing means for classifying and storing a multitude of parts for selective grouping and assembly in creating various designs;
  - retrieval means for selectively calling up parts from said memory and processing means;
  - image producing means for displaying selected groups of parts in contoured and assembled positions to form visible assemblies of parts; and,
  - manually operable interactive means for modifying characteristics of displayed parts in both image and memory form and for thus creating final and reproducible designs for the articles and their component parts.
2. A system for designing articles as set forth in claim 1 wherein said image producing means is adapted to display selected groups of parts in assembly and in three dimensions.
3. A system for designing articles as set forth in claim 2 wherein said image producing means takes the form of a CRT display screen with associated memory and processing means.
4. A system for designing articles as set forth in claim 2 wherein said image producing means is adapted to project a holographic image in space.

5. A system for designing articles as set forth in claim 2 wherein said image producing means takes the form of a multi-color projection system and at least one display screen combined with a corresponding multi-color sensitive viewing device and comprising a stereoscopic system.

6. A system for designing articles as set forth in claim 5 wherein a single display screen is employed.

7. A system for designing articles as set forth in claim 5 wherein multiple screens are employed for the multi-color image production.

8. A system for designing articles as set forth in claim 2 wherein said image producing means takes the form of a multiple projection system including polarizing means associated with each system for multi-directional polarization and which provides a resulting three dimensional image when viewed through a polarized viewing device.

9. A system for designing articles as set forth in claim 1 wherein said component parts comprise parts of articles of apparel.

10. A system for designing articles of apparel and the like as set forth in claim 9 wherein said apparel parts take the form of conventional two dimensional pattern pieces rendering the system component part design output compatible with and usable as input pattern design information for a conventional pattern grading and marker making system.

11. A system for designing articles of apparel and the like as set forth in claim 9 wherein said apparel parts take a three dimensional form compatible with apparel manufacture employing contour molding processes and the like.

12. A system for designing articles of apparel and the like as set forth in claim 9 wherein said image producing means is adapted to display selected groups of apparel parts in assembly and in two dimensional images but in a plurality of views.

13. A system for designing articles of apparel and the like as set forth in claim 9 wherein said image producing means is adapted to display selected groups of apparel parts in assembly and in three dimensions.

14. A system for designing articles of apparel and the like as set forth in claim 13 wherein said image producing means takes the form of a CRT display screen with associated memory and processing means.

15. A system for designing articles of apparel and the like as set forth in claim 13 wherein said image producing means is adapted to project a holographic image in space.

16. A system for designing articles of apparel and the like as set forth in claim 9 further comprising a digitizer for generating digital information for said memory and processing means in accordance with and defining various apparel parts.

17. A system for designing articles of apparel and the like as set forth in claim 16 wherein said digitizer and memory and processing means are

adapted to generate three dimensional digital information from two dimensional apparel parts for display of the latter in three dimensional form.

18. A system for designing articles of apparel and the like as set forth in claim 17 wherein said memory and processing means are adapted to convert three dimensional digital definitions of apparel parts to two dimensional digital definitions of said parts subsequent to interactive modification of said parts.
19. A system for designing articles as set forth in claim 9 wherein said image producing means takes the form of a multi-color projection system and at least one display screen combined with a corresponding multi-color sensitive viewing device and comprising a stereoscopic system.
20. A system for designing articles as set forth in claim 9 wherein said image producing means takes the form of a multiple projection system including polarizing means associated with each system for multi-directional polarization and

which provides a resulting three dimensional image when viewed through a polarized viewing device.

21. A system according to claim 1 substantially as described herein with reference to the accompanying drawings.
22. A system according to claim 9 substantially as described herein with reference to the accompanying drawings.
23. A system for designing articles having component parts substantially as described herein with reference to the accompanying drawings.
24. A method of designing articles having component parts employing a system as claimed in any one of the preceding claims.
25. An article designed by a method according to claim 24.
26. A system for designing articles comprising any novel feature or combination of features disclosed herein.